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Supplement of

Aerosol characteristics and particle production in the upper troposphere over the Amazon Basin

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Figure S1: Example of the center of a back-tracked parcel starting at the location of the HALO aircraft during flight AC18. This parcel started at 2014-09-28 20:34:53 UTC (same time as the HALO measurement) and was traced back in time in one-hour steps up to 120 hours, as shown in the time color scale on the right. The solid gray line is the full flight track of AC18. The top panel shows longitude vs. latitude and the bottom panel shows the longitude vs. altitude positions. We can see that this parcel stays in the UT within the 120 hours considered.

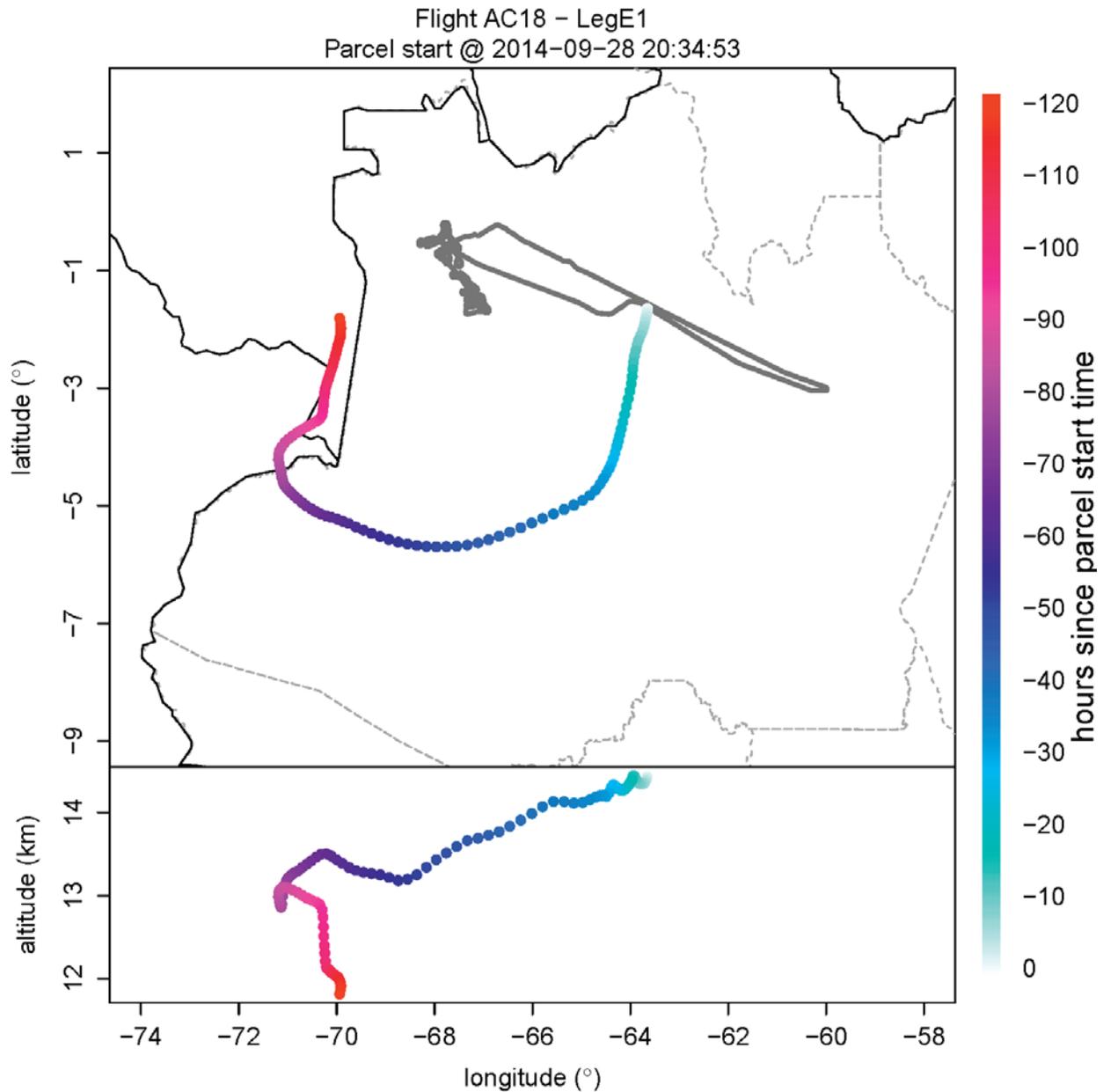


Figure S2: Examples of snapshots of the back-tracked parcel shown in Figure S1 matched in time to the closest GOES-13 infrared brightness temperature (T_b). Color dots are the same ones as in Figure S1, representing the position and backward time (in hours). Here the snapshots are zoomed in a $6^\circ \times 6^\circ$ box centered at the parcel location at the time shown on the top the snapshots and the number in parentheses is the number of hours backward from the parcel start (and flight measurement). Dashed boxes show the $1^\circ \times 1^\circ$ box centered in the back-tracked parcel within which we looked up the minimum T_b . This value is shown at the left bottom corner of each snapshot as well as the parcel altitude (in m) and GOES-13 infrared (IR) time.

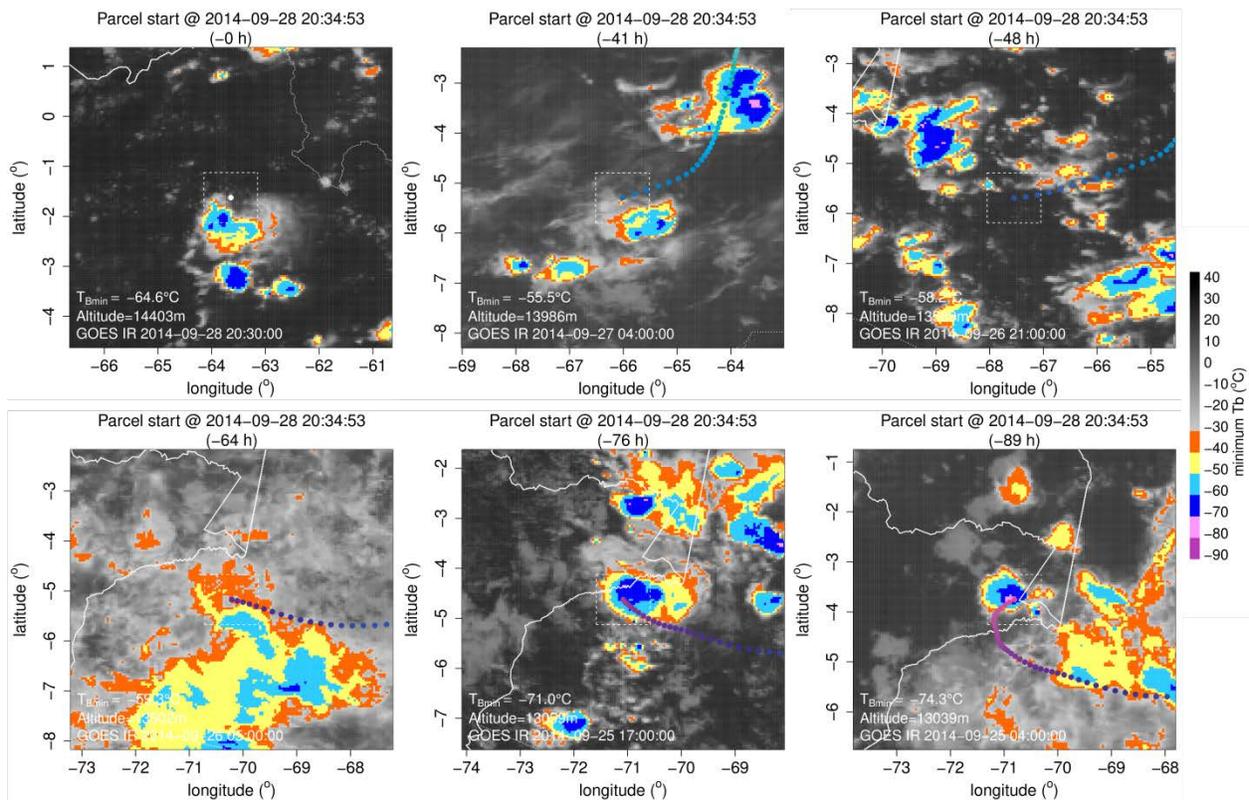


Figure S3: Summary of the back-tracked parcel positions (as in Fig. S1) with the minimum T_b tracked as shown in the snapshot examples of Figure S2. Here the back-track parcel position is colored with the value of minimum T_b found in the $1^\circ \times 1^\circ$ box.

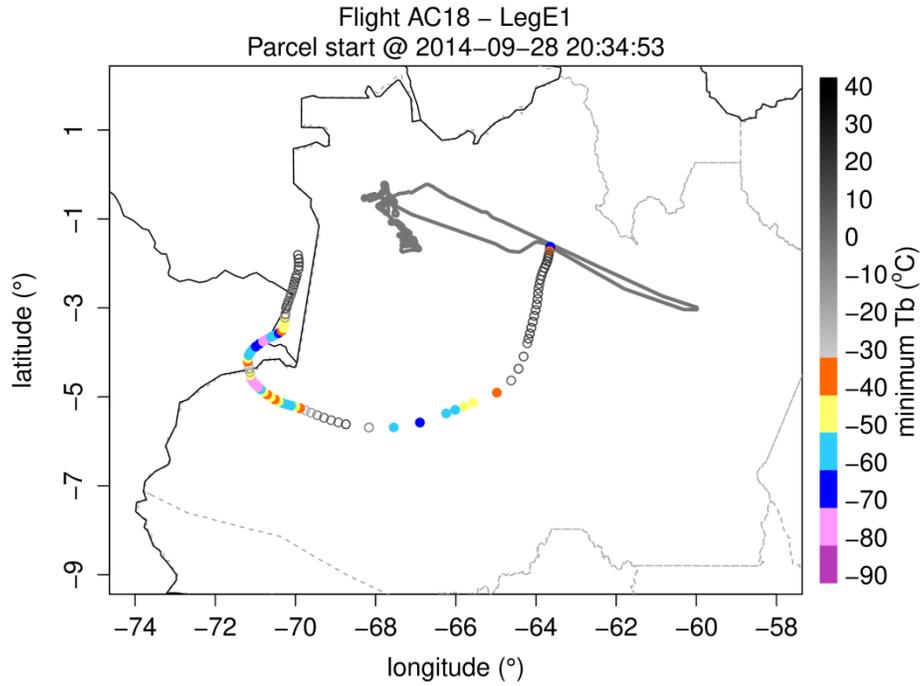


Figure S4. Mean vertical profiles of temperature, relative humidity and potential temperature (θ) from radiosoundings at Manacapuru.

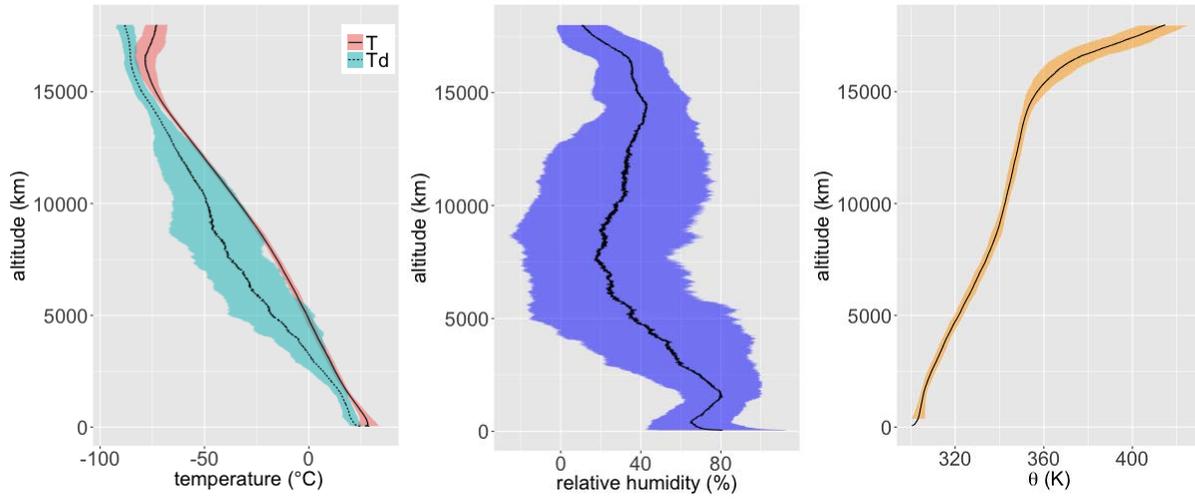
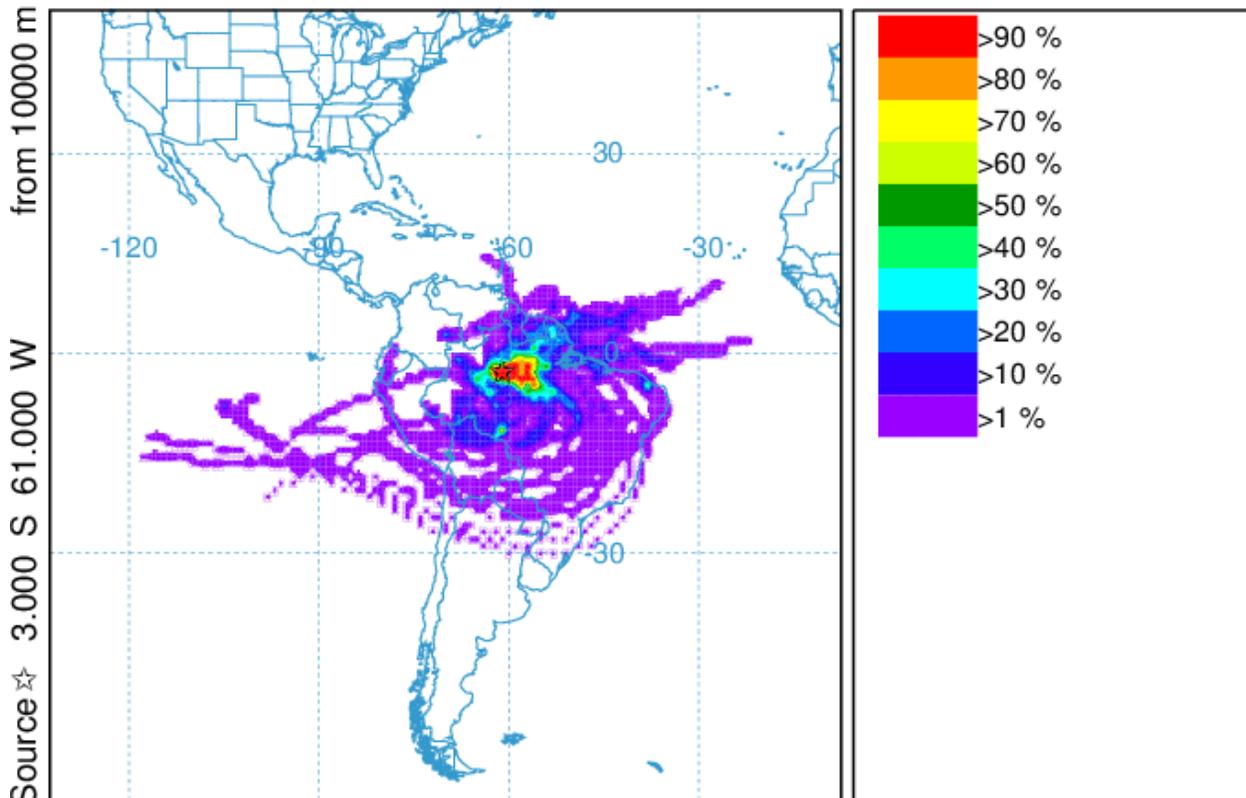


Figure S5: Trajectory statistics based on 120-hour backtrajectory calculations for September 2014, initialized at Manaus at an elevation of 10 km.

NOAA HYSPLIT MODEL - TRAJECTORY FREQUENCIES

endpts per grid sq./# trajectories (%) 0 m and 99999 m
 Integrated from 2100 30 Sep to 0900 27 Aug 14 (UTC) [backward]
 Freq Calculation started at 0000 00 00 (UTC)



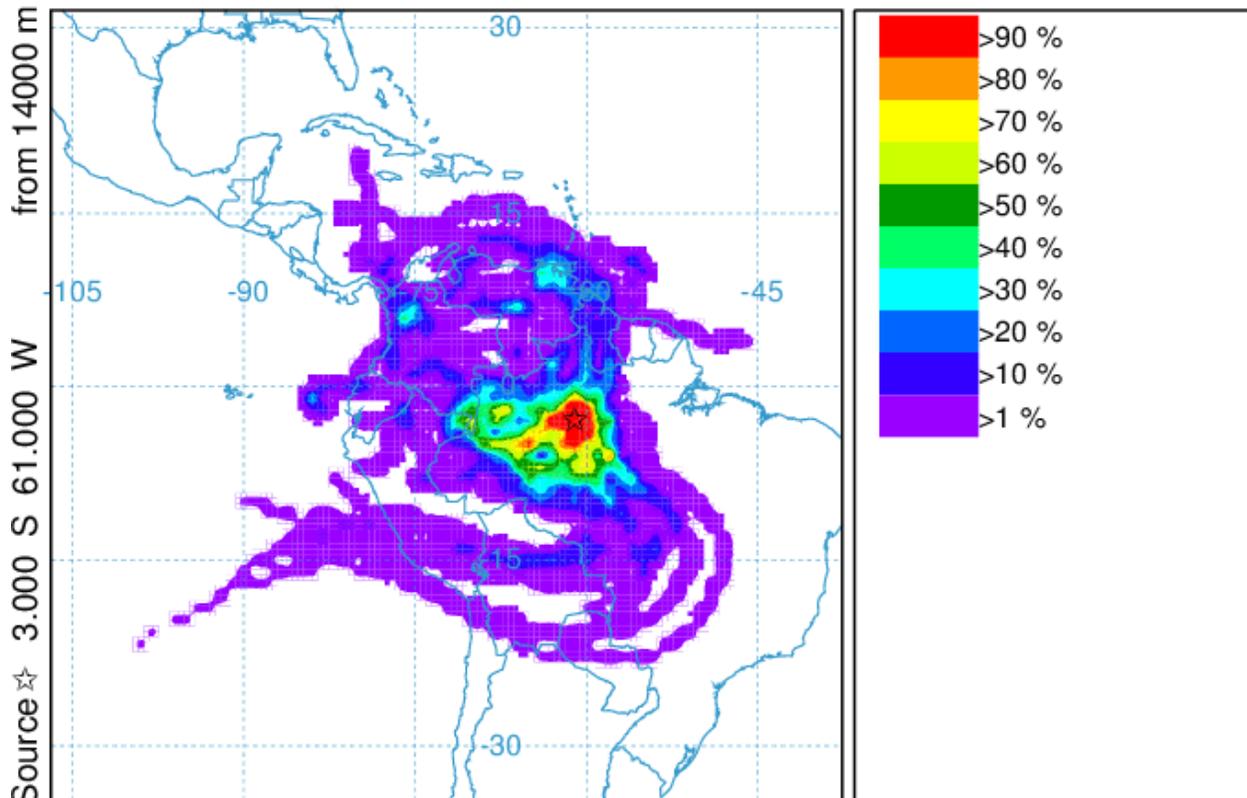
METEOROLOGICAL DATA

Job ID: 113173 Job Start: Wed Jan 11 22:11:28 UTC 2017
 Source 1 lat.: -3.000000 lon.: -61.000000 height: 10000 m AMSL
 Initial trajectory started: 2100Z 30 Sep 14
 Direction of trajectories: Backward Trajectory Duration: 120 hrs
 Frequency grid resolution: 1.0 x 1.0 degrees
 Endpoint output frequency: 60 per hour
 Number of trajectories used for this calculation: 60
 Meteorology: 0000Z 29 Sep 2014 - GDAS1

Figure S6: Trajectory statistics based on 120-hour backtrajectory calculations for September 2014, initialized at Manaus at an elevation of 14 km.

NOAA HYSPLIT MODEL - TRAJECTORY FREQUENCIES

endpts per grid sq./# trajectories (%) 0 m and 99999 m
Integrated from 2100 30 Sep to 0900 27 Aug 14 (UTC) [backward]
Freq Calculation started at 0000 00 00 (UTC)



METEOROLOGICAL DATA

Job ID: 113224 Job Start: Wed Jan 11 22:18:03 UTC 2017
Source 1 lat.: -3.000000 lon.: -61.000000 height: 14000 m AMSL
Initial trajectory started: 2100Z 30 Sep 14
Direction of trajectories: Backward Trajectory Duration: 120 hrs
Frequency grid resolution: 1.0 x 1.0 degrees
Endpoint output frequency: 60 per hour
Number of trajectories used for this calculation: 60
Meteorology: 0000Z 29 Sep 2014 - GDAS1

Figure S7: Time series plot of CN and CCN(0.52%) concentrations and flight altitude from flight AC09.

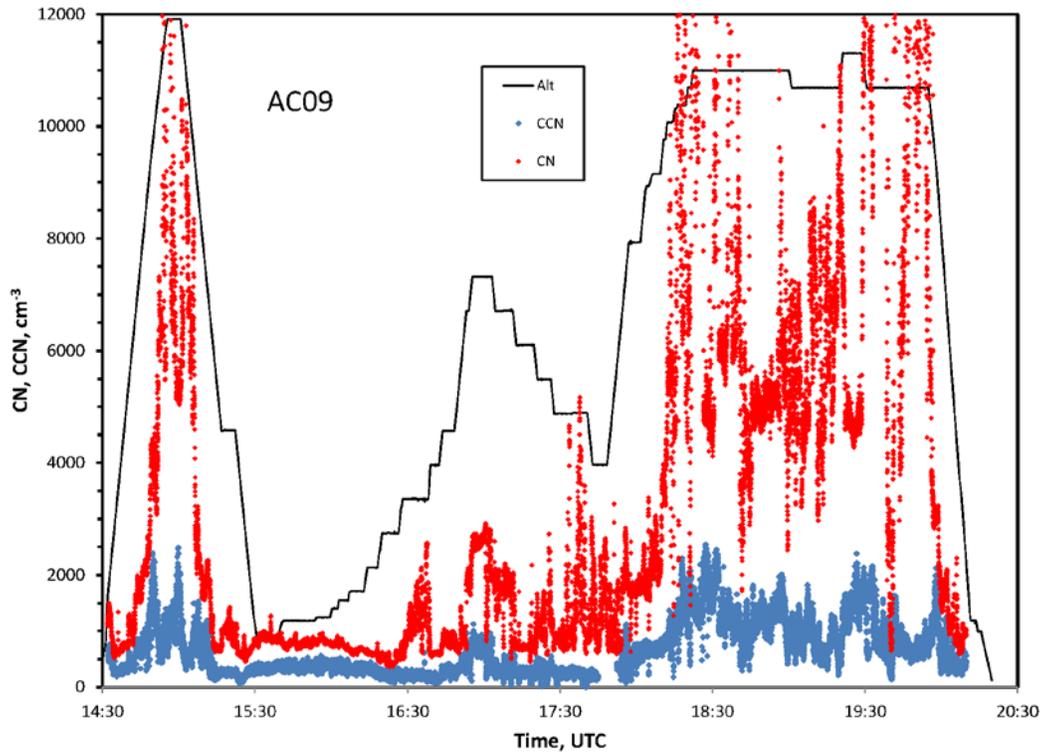


Figure S8: Scatter plot of CN vs O₃ concentrations from the UT in flight AC09.

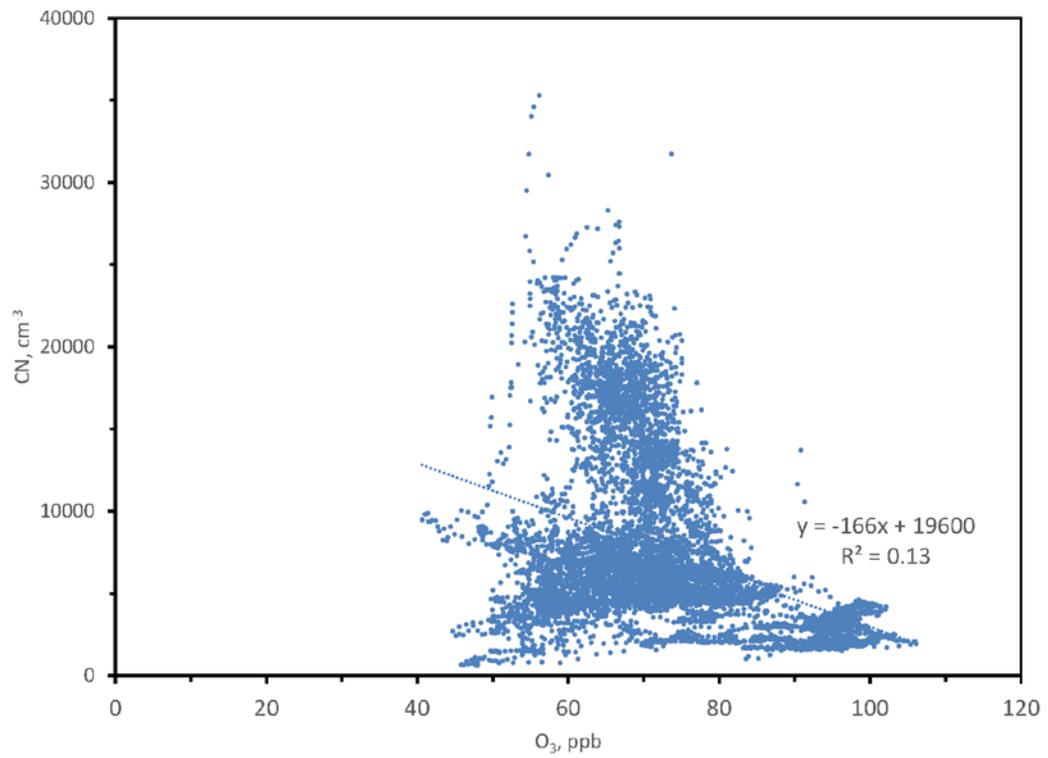


Table S1: Properties of the flight legs on which low aerosol concentrations were measured in the UT during ACRIDICON-CHUVA.

Flight	Leg	Start UTC	End UTC	Altitude range m	N _{CN} max. cm ⁻³	N _{CN} mean cm ⁻³	N _{CCN0.5} mean cm ⁻³	N _{acc} mean cm ⁻³	Ultrafine fraction	Trajectory type	Min T _b [min,max] ^a °C	Time since last DC [min,max] ^b hours	Time in DC [min,max] ^c hours	Sampling environment
AC16	L	16:23	16:30	12200-12600	3840	2460	169	142	0.94	B	[-62, -40]	[17, 18]	[5, 11]	clear air
AC18	L	15:17	15:19	9000-10500	1980	1620	487	236	0.85	C	[-2, 4.6]	-	-	clear air
AC19	L	20:14	20:23	11300-13800	2950	2160	834	207	0.90	A	[-74, -29]	[63, 104]	[3, 23]	clear air near outflow
AC20	L1	19:21	19:23	13600-13900	3040	1460	291	-	-	A	[-75, -70]	[0, 0]	[14, 16]	clear air near outflow
AC20	L2	19:33	19:35	14400	2190	1350	300	-	-	A	[-62, -61]	[0, 0]	[10, 12]	clear air near outflow
AC20	L3	19:52	19:57	14100	1950	1200	256	-	-	A	[-67, -68]	[0, 0]	[10, 13]	clear air near outflow

^{a)} Minimum and maximum temperature at top of most recent deep convection in grid boxes through which the center trajectories for the flight leg had passed.

^{b)} Trajectories were calculated for each minute of the leg, and for each trajectory the time between sampling and the most recent encounter with DC was determined. Given are the shortest and the longest of these time intervals.

^{c)} Minimum and maximum length of time that the trajectories from each leg had spent in grid boxes with DC.